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Nutrient Recovery for AD Systems

Lessons from Agro-Industrial Nutrient Management Experiences

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Multi User, Industrial Wastewater Management Concept

(Industrial Wastewater Treatment Plant – IWTP)

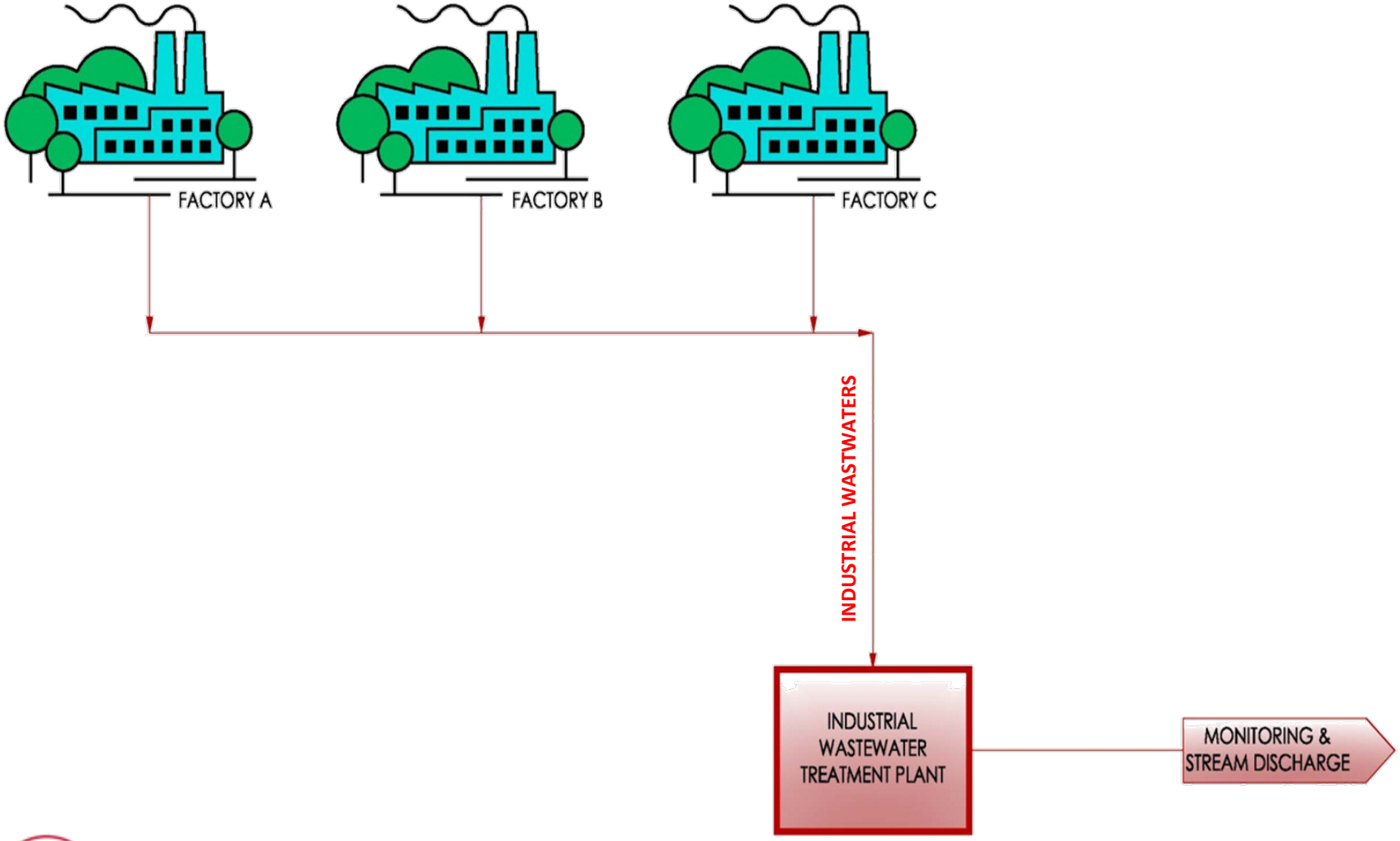
- Multi – Corporation, 3 Factory, Cooperative Project
- Complete WW Solution – Advanced Nutrient Removal
- **Energy Value Potential – 1.7 megawatt**
- WW Management Removed from Factory Activities
- IWTP More Capabilities/Capacity Than Practical For a Single Factory
- **Farm Interface for Nutrient & Irrigation**

DRIVERS

- City Cost of Service + 20 Year Commitment
- Capacity Restrictions (even with pre-treatment)
- H.S. WW's Not Compatible with City's New POTW Solution
- Factory Expansion & Product Diversity Constrained
- Factory Competitiveness Diminished

Multi – User Concept

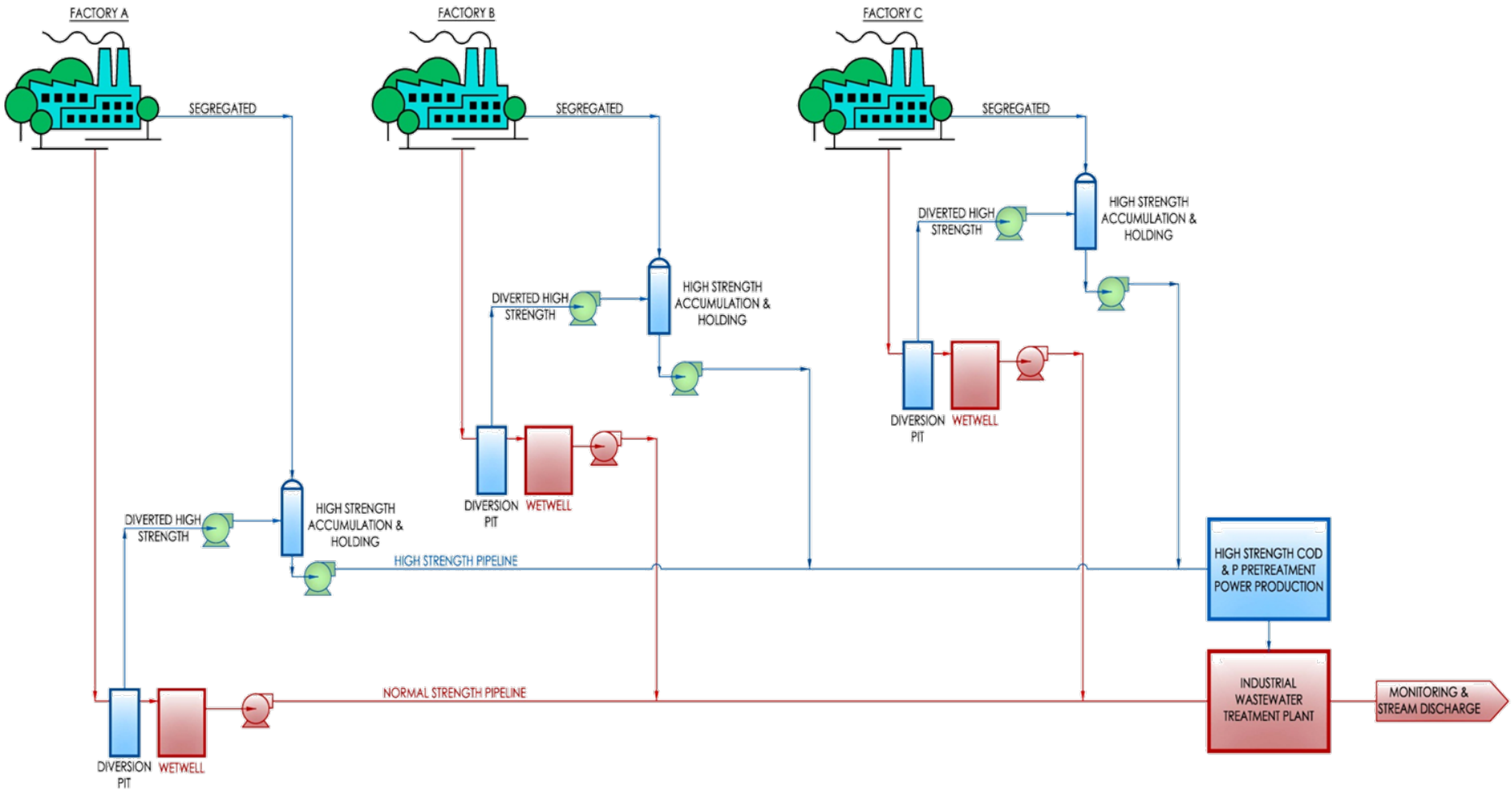
THREE FACTORIES to JOINT IWTP



Separate Segregated & Diverted HS Management With AD

- Higher Strength WW's (HS) More Efficiently Treated
  - Anaerobic Biological Treatment - MBR
  - Pellet Reactor P Removal
- Waste to Energy Opportunity Exploited
- Normal Strength WW's (NS) + Anaerobic Effluent Aerobically Treated
- Exceptional Load & Flow Range Capability Created
- Unit Processes & Materials of Construction Specific to the Industry Demands

NS & HS Management At Factory Sites



Funding Opportunities

Incentives Available to Industries vs. Municipalities

- Grant in Lieu of Energy Production Tax Credits
- NMTC
- Green Energy Power Purchase Agreement

Unique IWTP Process Configuration

Anearobic

Waste HS Characteristics/Effluent Goals Drive Process Drive

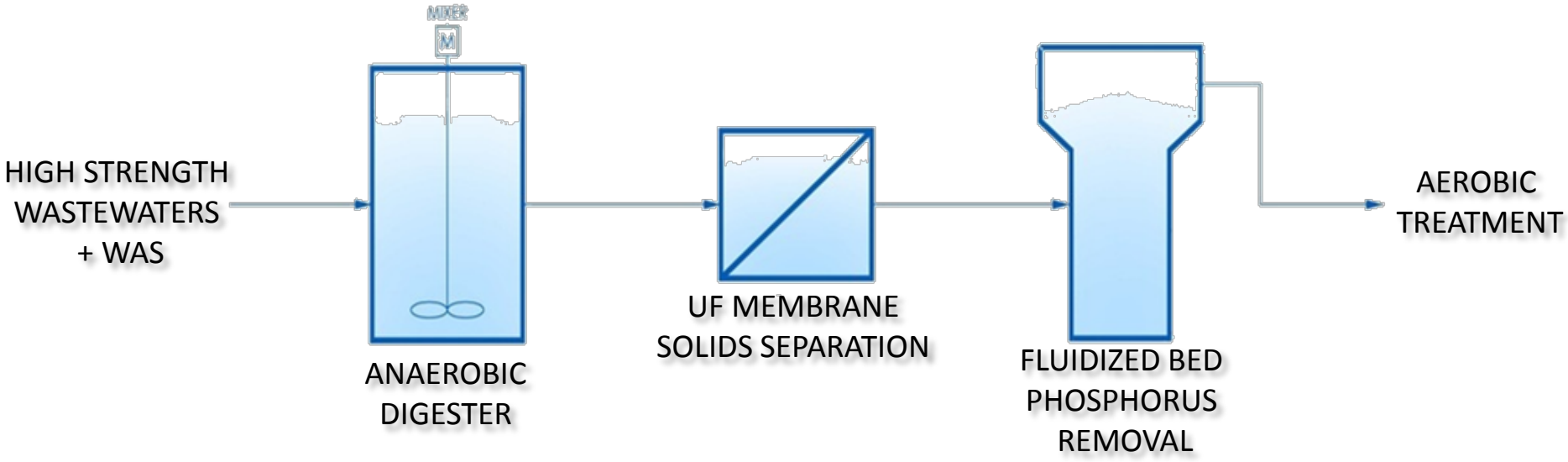
- H.S. WW's Treated in Complete Mix Anaerobic Digesters Followed by Fluidized Bed Phosphorus Pellet Reactors
- Pretreated H.S. + NS WW's to Aerobic Treatment

Aerobic

Phosphorus & BOD Loads + Effluent Limits Drive Design

- **P WQBEL @ 0.075 mg/L**
- BOD @ 213 lbs./Day - <20 mg/L @ Design Flow

Influent Character & Effluent Goals Drive Unique Solutions



ANAEROBIC PRE-TREATMENT

P-Limit Drives Process Design
Soils/Site Availability Dictate Physical Configuration

ANAEROBIC INFLUENT

Anaerobic Influent Characteristics

Parameter	Up to	Average
Flow	0.204 MGD	0.134 MGD
COD	57,200 mg/L	39,735 mg/L
Total Phosphorus	544 mg/L	356 mg/L

ANAEROBIC EFFLUENT

Parameter	Up to	Average	
		mg/L	% Removal
COD	1640 mg/L	313 mg/L	99.2%
Total Phosphorus	150 mg/L	58.4 mg/L	83.6%

AEROBIC INFLUENT

Aerobic Secondary Treatment

Parameter	Up to	Average
Flow	1.083 MGD	0.904 MGD
COD	3,585 mg/L	1,843 mg/L
Total Phosphorus	39 mg/L	20 mg/L

AEROBIC EFFLUENT

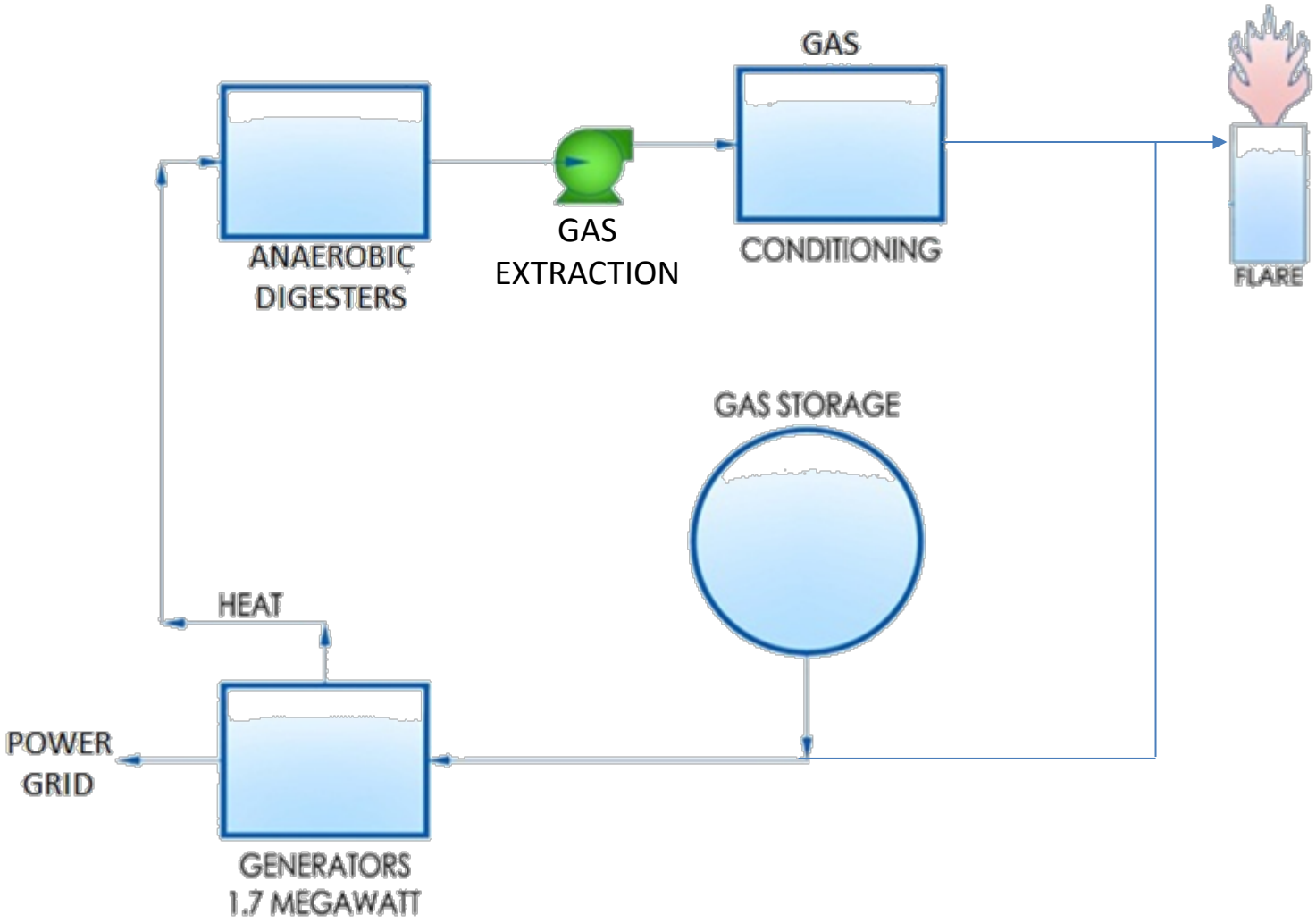
Aerobic Effluent

Parameter	Up to	Averaging
Flow	1.22 MGD	1.01 MGD
COD	57.6 mg/L	21.2 mg/L
Total Phosphorus	1.8 mg/L	0.3 mg/L

Unit Process Design Configured To Accommodate Anaerobic – Aerobic Process Needs

- Anaerobic Effluent – High Ammonia Concentration
- Aerobic Process Accommodations
  - Nitrification at aerations basins (ABs)
  - Denitrification at selector/denitrification tank ahead of the ABs
  - Mix only capabilities for denitrification in ABs
- Solids-Liquid Separation Denitrification to Manage Clarifier
  - Custom clarifier design
  - DAF clarifier effluent polishing

Bio-gas & Generation System Design to Maximize Energy Production/Enterprise Revenue



SUMMARY – CONCEPT

Industry Supported By Joint IWTP

- Capacity/Capabilities
- Flexibility
- Sustainability
- Expandable

SUMMARY - Uniquely Configured IWTP

- Factory H.S. Segregation, Diversion & Equalization
  - Powerful management tool for IWTP
  - Spill detection/control/minimization
  - Office site accumulation/equalization
- Separate H.S. Pre-Treatment
  - Gross COD & nutrient removal
  - Wide range of turn up/turn down capability
  - Cost effective treatment of highly concentrated WW's
  - Revenue from Power
- Robust Aerobic w/P Removal Enhancements

Exceeding Effluent Limit Expectations

Thank You!

Questions?